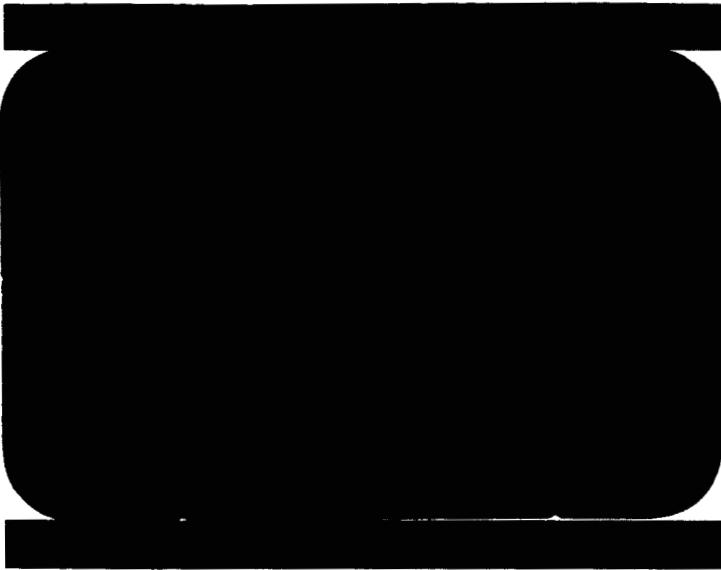


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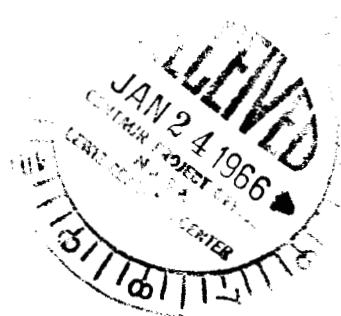
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REPORT GDC-BNZ64-042-08
DATE 31 DECEMBER 1965

CENTAUR LAUNCH COUNTDOWN

AUTOMATIC SEQUENCE FUNCTIONS

AND EVENT TIMES

ATLAS/CENTAUR

AC-8 EFFECTIVITY

GDC-BNZ64-042-08

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GENERAL DYNAMICS
Convair Division

FOREWORD

This report describes the Automatic Sequence and Time of Events of the Eastern Test Range (ETR), Complex 36B Launch Countdown of Atlas/Centaur Vehicle, AC-8.

It is prepared by Systems Engineering-Centaur, in accordance with Item 136, of Report Submittal Requirements, Data Document 55-00207F, Contract NAS 3-3232.

A report will be issued for each launch vehicle and submitted to NASA thirty days prior to launch in accordance with Change Order 276.

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1.0 INTRODUCTION

1.1 Purpose

This report defines the requirements for the functional control of the Atlas/Centaur vehicle AC-8, and Complex 36B Ground Support Equipment during the automatic countdown sequence for launch. The vehicle and GSE must meet these requirements.

The automatic countdown sequence commences with TCC start (Test Conductor Start) and continues through Atlas LV-3C engine firing, thrust buildup, vehicle release, and liftoff. The functional control requirements are described in detail with respect to:

- a. Sequence of events.
- b. Nominal times of occurrence.
- c. Constraints on delays, holds, recycle, or launch abort.

1.2 Automatic Countdown Sequence

a. Background

For several weeks or months prior to launch, the components and systems of the vehicle are adjusted, calibrated, and tested at ETR. Approximately eight hours before launch, systems are sequentially activated, tested and thoroughly checked out. Operations are accomplished to bring all systems to a ready status.

Because of human reaction time, manual action cannot be relied upon to verify, within the relatively close timing tolerance, the many functions which occur during the terminal seconds of countdown. The terminal countdown sequence is, therefore, automated. From the commencement of the automatic countdown until approximately T-1 seconds when the vehicle is committed to be released, the test conductor has the capability of manually stopping the countdown.

b. Selection Criteria for Automatic Countdown Functions

The automatic countdown logic verifies the readiness of all systems for start of the automatic sequence. Generally, during the automatic countdown, individual functions and system status reports are continually locked out of the logic after successful activation has been monitored. This technique decreases the possibility of a GSE failure aborting a launch. A pre-release cutoff capability is maintained until approximately T-1 second to assure readiness of all major systems.

Only those functions which are time sensitive towards vehicle liftoff are included in the automatic sequence. The successful activation of each function included in the sequence must be monitored and interlocked into the logic as a condition for continuing the countdown to the next major phase. Phases of the countdown are summarized in the index of Section 2.0

1.3 Report Objective

This document has been prepared with the following objectives in mind.

- a. Clarification of automatic countdown sequences and constraints.

Launch Operational personnel require this data to rapidly evaluate countdown progress and possible actions in the event of difficulties. Designers are required to verify that only those time dependent functions have been included in the automatic portion of the countdown and that these functions have been properly interlocked and sequenced in the event of launch, recycle, or abort. System analysts must continually review this abbreviated presentation while analyzing the source data for sneak circuits or operational simplification.

- b. Present the composite launch sequence, both actual and planned for Atlas/Centaur launches.

During the course of Centaur development, many changes have been and will continue to be individually approved and incorporated into the vehicle and ground support equipment. This document presents the composite effect of these changes upon the most critical portion of the vehicle checkout and launch operations.

- c. Establish a base line for changes to future launch sequences.

Analysis of the automatic countdown sequence indicates that simplification could be effected for operational missions. This report presents an abbreviated format for analyzing the effect of changes and obtaining agreement prior to revision of the more extensive source documents. It is intended to present proposed revisions as supplements to the report and approved revisions by direct incorporation.

1.4 Limitations

The data provided reflect requirements and configurations valid at time of document issue. The REMARKS Column is included for information only.

Applicable modifications will be issued by document revision.

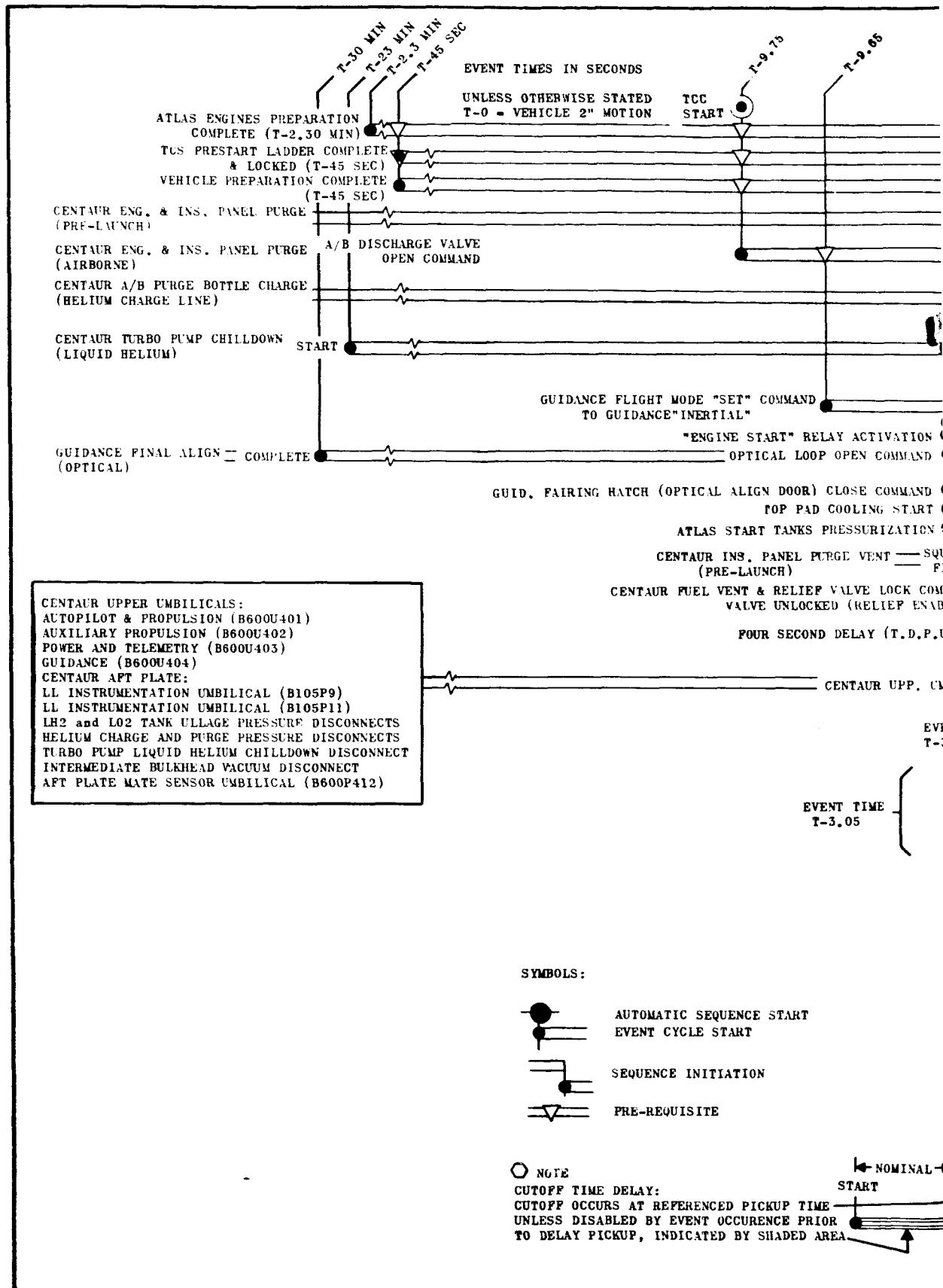
1.5 References

- a. Centaur Launch Countdown Automatic Sequence Functions and Event Times, Atlas/Centaur, AC-4 through AC-15 effectivity, GDC-BNZ64-042, Revision D, 22 February 1965.
- b. Centaur Launch Countdown Automatic Sequence Functions and Event Times, Atlas/Centaur, AC-6 effectivity, GDC-BNZ64-042-06, Revision F, 8 October 1965.
- c. Centaur Launch Countdown Automatic Sequence Functions and Event Times, Atlas/Centaur, AC-7 effectivity, GDC-BNZ64-042-07, 15 September 1965.

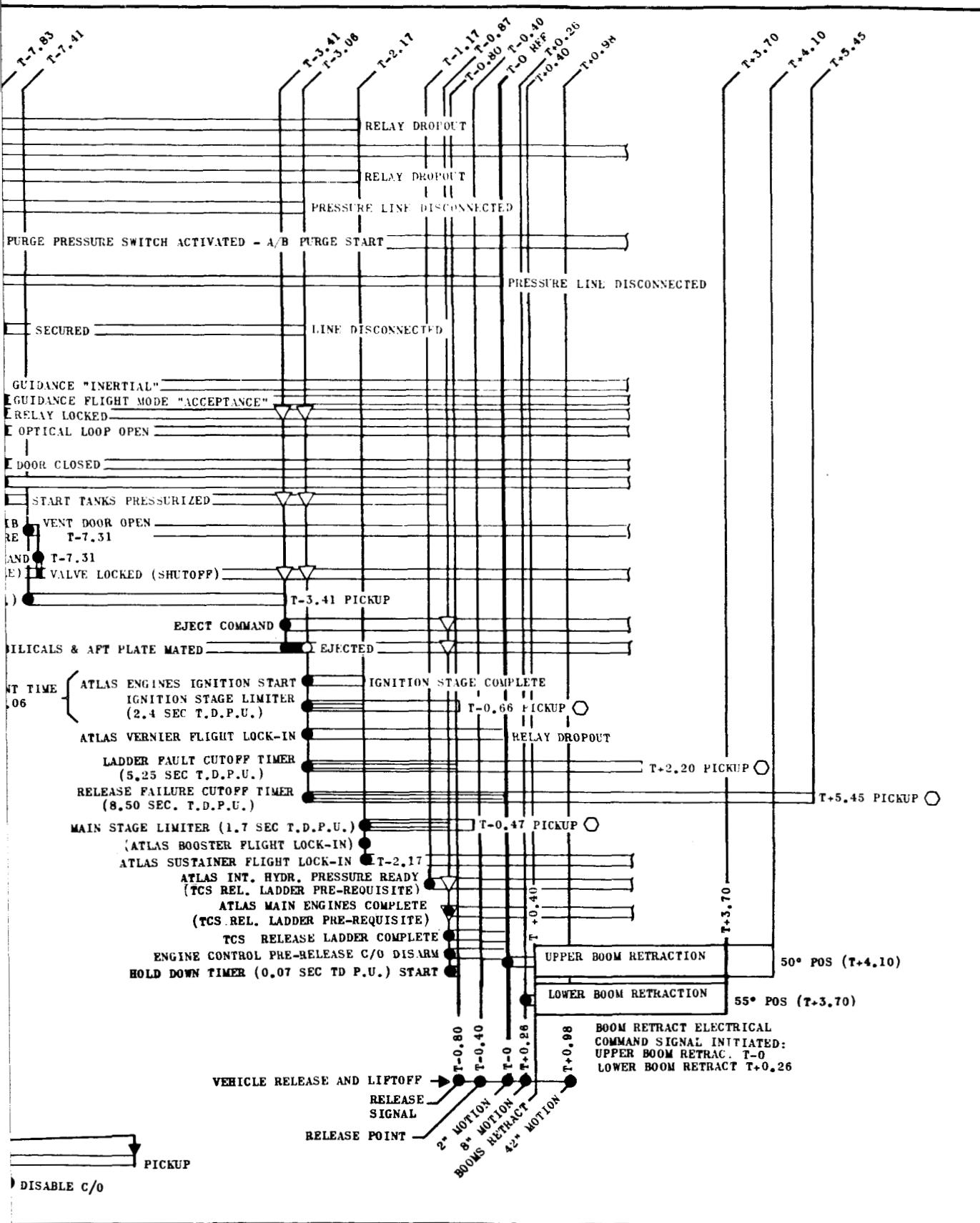
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SECTION 2.0

LAUNCH COUNTDOWN AUTOMATIC SEQUENCE
PREREQUISITES AND AUTOMATIC SEQUENCE EVENTS AC-8,
ETR COMPLEX 36B LAUNCH EFFECTIVITY



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AC-8 Launch Countdown Automatic Sequence Functional and Nominal
Event Times

2

EVENT SEQUENCE AND TIMES

EVENT TIME ACTUAL	LL MEASUREMENT ACTIVATED (1) DEACTIVATED (0)	FUNCTION DESCRIPTION	REMARKS	REV. LTR
		<p>A. PRESTART LADDER PREPARATION</p> <p>NOTE: EVENT TIMES SHOWN AS 4.3 MIN, FOR EXAMPLE, ARE TO BE READ AS 4 MINUTES, 30 SECONDS.</p> <ol style="list-style-type: none"> 1. LAUNCH/TEST SWITCH TO LAUNCH <ol style="list-style-type: none"> a. HOLDDOWN/AND RELEASE READY b. BOOM SYSTEM READY c. UMBILICAL CONTROL READY d. GUIDANCE READY e. WATER SYSTEM READY f. 2ND STAGE PRESS READY g. 1ST STAGE RANGE SAFETY READY h. 2ND STAGE RANGE SAFETY READY i. 1ST STAGE TELEMETRY READY j. 2ND STAGE TELEMETRY READY k. 2ND STAGE POWER INTERNAL l. 1ST STAGE TANKING READY m. 1ST STAGE POWER INTERNAL n. 2ND STAGE ENGINES READY (SEE NOTE AT T-60 SEC) o. 2ND STAGE TANKING READY p. RANGE READY <p>NOTE: VISUAL VERIFICATION OF PROPER H₂O₂ PRESSURE.</p> <ol style="list-style-type: none"> q. 1ST STAGE INTERNAL PNEUMATICS READY r. PAYLOAD DISCONNECT READY s. 2ND STAGE FLIGHT CONTROL READY t. 1ST STAGE FLIGHT CONTROL READY u. BOOSTER C/O RELAY NOT ACTIVATED v. PRESTART LADDER COMPLETE <p>NOTES: 1) 1.a, 1.c, 1.d, 1.e, AND 1.p ARE PREREQUISITES FOR PRESTART LADDER COMPLETE UP TO ENGINE START RELAY LOCKUP WHICH BYPASSES THESE FUNCTIONS.</p> <p>2) PRESTART LADDER COMPLETE (2106A1K1) IS A PREREQUISITE FOR VEHICLE PREPARATION COMPLETE (592K25C) AND RELEASE LADDER COMPLETE (2106A7K1) - RELEASE PERMIT</p> <p>(T-7.83 SEC) REF</p> <p>(T-0.87 SEC) REF</p>		

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EVENT SEQUENCE AND TIMES (CONT'D)

EVENT TIME ACTUAL	LL MEASUREMENT ACTIVATED (1) DEACTIVATED (0)	FUNCTION DESCRIPTION	REMARKS	REV LTR
T-280 MIN (T-3.06 SEC) REF	B. CENTAUR ENGINES AND INSULATION PANEL PRELAUNCH PURGE 1. PRELAUNCH PURGE START NOTE: PRELAUNCH PURGE IS CONTINUOUS THROUGH AUTOMATIC SEQUENCE START UP TO AFT PLATE EJECT.			
T-80 MIN T-30 MIN	C. GUIDANCE FINAL ALIGN (OPTICAL) 1. FINAL ALIGN START 2. FINAL ALIGN COMPLETE NOTE: IF OPTICAL ALIGN IS ACQUIRED AT START OF AUTOMATIC SEQUENCE, CONTINUOUS RETENTION THRU AUTOMATIC SEQUENCE START IS NOT REQUIRED.			
T-23 MIN (T-7.83 SEC) REF	D. CENTAUR TURBO PUMP CHILL OPERATION 1. CHILL START 2. CHILL CONTINUED THRU AUTOMATIC SEQUENCE START 3. CHILL SECURE (AUTO COMMAND) REF NOTE: ACTUAL TIME OF CHILDDOWN COMPLETE IS NOT A CONSTRAINT ON VEHICLE RELEASE READY.			
T-2.3 MIN	E. ATLAS ENGINES PREPARATION AN 1816 X (1) AP 1609 X (0) AP 1610 X (0) AP 1073 X (1) AP 1074 X (1) AP 1613 X (0) AP 1614 X (0) AP 1068 X (1) AP 1067 X (1) AP 1199 X (1) AP 1070 X (1) AP 1069 X (1) AP 1203 X (1)	1. PYROTECHNIC BYPASS a. VERNIER PYRO BYPASS - HYPERGOL POSITION b. BOOSTER PYRO BYPASS - HYPERGOL POSITION c. SUSTAINER PYRO BYPASS - HYPERGOL POSITION 2. ENGINE CONTROL ARM SWITCH TO ARM POSITION a. FUEL START TANK PRESSURE SWITCH OFF b. LO ₂ START TANK PRESSURE SWITCH OFF c. VERNIER #1 PROPELLANT VALVE CLOSED d. VERNIER #2 PROPELLANT VALVE CLOSED e. VERNIER #1 CHAMBER PRESSURE SWITCH OFF f. VERNIER #2 CHAMBER PRESSURE SWITCH OFF g. IGNITOR LINKS MONITOR RELAY ACTIVATION h. DETECTOR LINKS PILOT RELAY ACTIVATION i. BOOSTER #1 MAIN LO ₂ VALVE CLOSED j. BOOSTER #2 MAIN LO ₂ VALVE CLOSED k. SUSTAINER LO ₂ HEAD SUPPRESSION VALVE CLOSED l. BOOSTER #1 FUEL VALVE CLOSED m. BOOSTER #2 FUEL VALVE CLOSED n. SUSTAINER FUEL PU VALVE CLOSED	5092K16C 5092K12C 5092K15C 5092K34C 5092K36C 5092K45C 5092K46C 5092K47C 5092K48C 5092K47I 5092K68I 5092K62C 5092K63C 5092K64C 5092K77C 5092K78C 5092K79C	

EVENT SEQUENCE AND TIMES (CONT'D)

		AP 1071 X (1) AP 1335 X (1) AP 1618 X (0)	<ul style="list-style-type: none"> o. BOOSTER GAS GENERATOR VALVE CLOSED p. SUSTAINER GAS GENERATOR VALVE CLOSED q. BOOSTER #1 FUEL INJECTOR MANIFOLD PRESSURE SWITCH OFF r. BOOSTER #2 FUEL INJECTOR MANIFOLD PRESSURE SWITCH OFF s. SUSTAINER FUEL INJECTOR MANIFOLD PRESSURE OFF 	5092K75C 5092K76C 5092K83C	
		AP 1619 X (0) AP 1623 X (0) AP 1137 X (1)	<ul style="list-style-type: none"> 3. ATLAS ENGINES PREPARATION COMPLETE <p>NOTE: 2.a AND 2.b ARE BYPASSED BY ENGINE START RELAY LOCKUP (5092K31C1 N.O. CONTACTS PRIOR TO INITIATION OF START TANKS PRESSURIZATION COMMAND.</p> <p>2.c THRU k ARE BYPASSED AT ENGINES IGNITION START BY RELAY 5092K43C2 N.O. CONTACTS.</p>	5092K80C 5092K82C 5092K24C	
T-2.3 MIN (T-7.8 SEC) REF		(T-3.06 SEC) REF	F. VEHICLE PREPARATION COMPLETE CONTINGENT UPON: 1. ATLAS ENGINES PREPARATION COMPLETE 2. PRESTART LADDER COMPLETE	5092K25C	
T-45 SEC		AP 1575 X (1)	G. LAUNCH COUNTDOWN AUTOMATIC SEQUENCE PREPARATION	<p>T-90 SEC THRU AUTO SEQ START</p> <ol style="list-style-type: none"> 1. CENTAUR LO₂ FILL AND DRAIN VALVE CLOSED 2. SET FINAL ATLAS ROLL PROGRAM 3. PU VEHICLE ELECTRONIC PACKAGE CONTROL NULL OFF 4. VERIFY PNEUMATIC EMERGENCY OVER-RIDE 5. ATLAS LO₂ FILL AND DRAIN VALVE CLOSED 6. ATLAS PRESSURIZATION TO INTERNAL 7. ATLAS AND CENTAUR PROGRAMMER ARM 8. VERIFY CENTAUR PU NULL 9. STATUS REPORT (GO/NO GO) <ul style="list-style-type: none"> a. ATLAS PROPELLANTS b. CENTAUR PROPELLANTS c. ATLAS PRESSURIZATION d. CENTAUR PRESSURIZATION e. ATLAS HYDRAULICS f. GUIDANCE g. SPACECRAFT h. LAUNCH DIRECTOR 	5092K24C 2106A1K1 T-90 SEC THRU AUTO SEQ START

EVENT SEQUENCE AND TIMES (CONT'D)

EVENT TIME ACTUAL	LL MEASUREMENT ACTIVATED (1) DEACTIVATED (0)	FUNCTION DESCRIPTION	REMARKS	REV LTR
T-40 SEC		<p>G. LAUNCH COUNTDOWN AUTOMATIC SEQUENCE PREPARATION (CONT'D)</p> <p>10. EVACUATION SWITCHES TO OIL/EVACUATE</p> <p>11. TELEMETRY CALIBRATION (12 SEC)</p> <ul style="list-style-type: none"> a. CALIBRATION START b. CALIBRATION COMPLETE <p>12. BLOCKHOUSE MONITOR SEQUENCER HOLD AT T-10 SEC</p> <p>13. ALL RECORDERS TO FAST</p> <p>NOTES: 1) AUTOMATIC LAUNCH COUNTDOWN SEQUENCE IS STARTED BY MOMENTARY DEPRESSION OF TCC START SWITCH AT THE DISCRETION OF THE TEST CONDUCTOR.</p> <p>2) REFERENCE DESIGNATIONS IN REMARKS COLUMN ARE APPLICABLE TO ETR COMPLEX 36B (GSE).</p> <p>3) LL MEASUREMENT REFERENCES ARE APPLICABLE TO ETR COMPLEX 36B (GSE).</p> <p>4) AUTOMATIC SEQUENCE EVENT TIMES ARE REFERENCED TO T-0 = VEHICLE 2" MOTION.</p> <p>5) NOMINAL EVENT CYCLE TIMES ARE DERIVED FROM PAST HISTORY DATA AND DO NOT NECESSARILY REFLECT DESIGN LIMIT VALUES.</p>		

TABLE 1. SUMMARY OF LAUNCH COUNTDOWN AUTOMATIC SEQUENCE EVENT TIME CONSTRAINTS

SYSTEM	EVENT CYCLE CONSTRAINTS	NOMINAL CYCLE TIME	NOTE
1. GUIDANCE SYSTEM	ACTUAL ELAPSED TIME FROM FLIGHT MODE ACCEPTANCE TO VEHICLE 2" MOTION IS NOT TO EXCEED 43 SECONDS.	7.83 SEC	
2. CENTAUR PRESSURIZATION	ACTUAL ELAPSED TIME FROM LH2 VENT VALVE LOCKED TO VEHICLE 2" MOTION IS NOT TO EXCEED 12 SECONDS.	7.33 SEC	
3. ATLAS PRESSURIZATION	ACTUAL ELAPSED TIME FROM START TANKS PRESSURIZED TO ATLAS ENGINES IGNITION START IS NOT TO EXCEED 30 SECONDS.	4.35 SEC	
4. ATLAS ENGINE CONTROL	ACTUAL ELAPSED TIME FROM ATLAS ENGINES IGNITION START TO MAIN STAGE IGNITION COMPLETE IS NOT TO EXCEED 2.4 SECONDS.	0.89 SEC	(A)
5. ATLAS ENGINE CONTROL	ACTUAL ELAPSED TIME FROM MAIN STAGE IGNITION COMPLETE TO MAIN ENGINES COMPLETE IS NOT TO EXCEED 1.7 SECONDS.	1.30 SEC	(A)
6. TEST CONDUCTOR SYSTEM	ACTUAL ELAPSED TIME FROM ATLAS VERNIER FLIGHT LOCK-IN TO RELEASE SIGNAL INITIATION IS NOT TO EXCEED 5.25 SECONDS.	2.26 SEC	(A)
7. TEST CONDUCTOR SYSTEM	ACTUAL ELAPSED TIME FROM ATLAS VERNIER FLIGHT LOCK-IN TO VEHICLE 2" MOTION IS NOT TO EXCEED 8.50 SECONDS.	3.06 SEC	(A)
8. TEST CONDUCTOR SYSTEM/ ATLAS ENG. CONTROL SYSTEM	MANUAL COMPLETE CUTOFF IS TO BE INITIATED IF ATLAS VERNIER ENGINES IGNITION IS NOT INDICATED (VISUAL OBSERVATION) PRIOR TO BLOCKHOUSE MONITOR SEQUENCER T-0 TIME. NOTE (A): THE CYCLE TIMES FOR THESE EVENTS ARE AUTOMATICALLY SENSED.	3.06 SEC	

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EVENT SEQUENCE AND TIMES (CONT'D)

EVENT TIME ACTUAL	LL MEASUREMENT ACTIVATED (1) DEACTIVATED (0)	FUNCTION DESCRIPTION	REMARKS	REV LTR
2-08-10		H. LAUNCH COUNTDOWN AUTOMATIC SEQUENCE EVENTS NOTES: 1) MANUAL HOLD OR INTERRUPTION OF AUTOMATIC SEQUENCE EVENTS AFTER AUTOMATIC SEQUENCE START IS INITIATED AT THE DISCRETION OF THE TEST CONDUCTOR OR THE PAD SAFETY OFFICER. 2) EVENT TIMES ARE IN SECONDS UNLESS OTHERWISE STATED.		
T-9.75	AP 1161 X (1)	1. AUTOMATIC SEQUENCE START TCC START SWITCH DEPRESSED MOMENTARILY a. AUTOMATIC SEQUENCE START LOCKUP. START SWITCH IS BYPASSED THRU N.C. RESET SWITCH AND N.O. CONTACTS OF START A/B PURGE RELAY. 1) A/B PURGE START COMMAND a) A/B PURGE DISCHARGE VALVE TO FLOW POS. b) A/B PURGE PRESSURE INCREASE IS INDICATED BY A PRESSURE SWITCH AND MONITOR LIGHT c) A/B INSULATION PANEL PURGE OK. FLIGHT MODE SET COMMAND TO GUIDANCE	2104S3 INS. PANEL & ENG. OVERBOARD DUCTS 5036A4K1 2084DS7 2098A9K7 {TO (RCA) TB6-12 THRU 2098A9K8 (ENGINE CONTROL)	
T-9.74	CF 1141 X (1)	b. GUIDANCE TO FLIGHT MODE SEQUENCE START 1) GUIDANCE TO FLIGHT MODE "SET" COMMAND GATING POINT TO A/B COMPUTER NOTE: ELAPSED TIME FROM FLIGHT MODE "SET" TO FLIGHT MODE ACCEPT DISCRETE IS 1.18 SECONDS (NOM.) WITH AN UNCERTAINTY OF +0.62, -0 SECONDS.		
T-9.65		2. GUIDANCE FLIGHT MODE ACCEPTANCE NOTE: NOMINAL FLIGHT MODE ACCEPT ASSUMES THE MAXIMUM ELAPSED TIME OF 1.80 SECONDS. a. GUIDANCE FLIGHT MODE ACCEPT DISCRETE FROM A/B COMPUTER (L9) b. TCC GUIDANCE FLIGHT MODE ACCEPT 1) TOP PAD COOLING START COMMAND 2) "ENGINE START" SIGNAL TO SEQUENCER 3) TURBO PUMP CHILDDOWN SECURE COMMAND 4) "ENGINE START" RELAYS LOCKUP		2106A1K2 {TO (RCA) TB6-14 THRU 2098A9K6 (ENGINE CONTROL) 5092K31C
T-7.85	CI 1088 X (1)			
T-7.83	CN 1422 X (1) CN 1423 X (1)			

EVENT SEQUENCE AND TIMES (CONT'D)

T-7.82	AP 1608 X (1)		NOTE: AFTER ENGINE START RELAY LOCKUP, THE AUTOMATIC SEQUENCE CANNOT BE INTERRUPTED BY ACTIVATION OF THE START RESET SWITCH.	2098A9K6 2098A9K9
T-7.41	AP 1610 X (1)	5) ATLAS START TANK PRESSURIZATION COMMAND a) LO ₂ START TANK PRESSURIZED (1) PRESSURE SWITCH "OFF" DROPOUT (2) START TANK PRESSURIZED	L31P (A/B) 5092K35C 5092K36C	
T-7.41	AP 1609 X (1)	b) FUEL START TANK PRESSURIZED (1) PRESSURE SWITCH "OFF" DROPOUT (2) START TANK PRESSURIZED	5092K33C 5092K34C	
T-7.41	AP 1610 X (1) AP 1609 X (1)	NOTES: 1) ELAPSED TIME FROM FLIGHT MODE ACCEPT TO VEHICLE 2" MOTION (T-0 REF. TIME) IS NOT TO EXCEED 43 SECONDS. 2) START TANKS PRESSURIZED TO ATLAS ENG. IGNITION START IS NOT TO EXCEED 30 SEC. (ENGINE IGNITION START T-3.06 SEC NOM) 3) HOLDS AFTER FLIGHT MODE ACCEPT REQUIRE RECYCLE TO GUIDANCE FINAL ALIGN OR LAUNCH ABORT.	LO ₂ TANK FUEL TANK (5092K36C) (5092K34C)	
CN 1826 X (1)		NOTE: INITIATION OF THE FOLLOWING EVENTS IS CONTINGENT UPON: 1) ENGINE CONTROL ARM SWITCH ARMED 2) "ENGINE START" RELAY LOCKUP 3) ATLAS START TANKS PRESSURIZED 4) MANUAL OR AUTOMATIC ENGINE CUTOFF NOT INITIATED	(2024S13C) (5092K31C) (5092K34C & K36C) (5092K911C REF) 2024A4K1	
T-7.31	CN 1103 X (1) CF 1036 X (1)	a. FOUR SECONDS DELAY TIMER START b. INSULATION PANEL PURGE VEN ¹ SQUIB FIRING COM- MAND (PRE-LAUNCH VENT DOOR OPEN COMMAND) NOTE: ANY HOLD AFTER PANEL VENT OPENS, WHICH REQUIRES AUTOMATIC SEQUENCE TO BE INTERRU- PTED, IS TO BE CONSIDERED CAUSE FOR LAUNCH ABORT.		
T-7.29		4. INSULATION PANEL PRE-LAUNCH VENT OPEN a. CENTAUR FUEL (LH ₂) VENT VALVE LOCK COMMAND 1) FUEL (LH ₂) VENT VALVE LOCKED INDICATED NOTE: ACTUAL ELAPSED TIME FROM CENTAUR FUEL (LH ₂) VENT VALVE LOCKED INDICATION TO VEHICLE 2" MOTION (T-0 REFERENCE TIME) IS NOT TO EXCEED 12 SECONDS.		

EVENT SEQUENCE AND TIMES (CONT'D)

EVENT TIME ACTUAL / NOMINAL	LL MEASUREMENT ACTIVATED (1) DEACTIVATED (0)	FUNCTION DESCRIPTION	REMARKS	REV LTR
2-08-12		H. LAUNCH COUNTDOWN AUTOMATIC SEQUENCE EVENTS (CONT'D)		
T-6.00		b. H2 VENT STACK PURGE START 5. PAD AREA FIXED CAMERAS COVERAGE START (SEQUENCER COMMAND)	5036A6K4	
T-3.41	CN 1057 X (1) CN 1614 X (1) CN 1233 X (1)	6. CENTAUR UPPER UMBILICALS AND AFT PLATE EJECT NOTE: EJECT SIGNAL INITIATION IS CONTINGENT UPON: 1) PRE-REQUISITES 3.1) THRU 3.4) RETAINED 2) FUEL VENT VALVE LOCKED RETAINED 3) FOUR SECOND DELAY PICKUP a. EJECT SIGNAL INITIATION 1) UPPER UMBILICALS ELECTRICAL EJECT 2) AFT PLATE PNEUMATIC UNLATCH & EJECT 3) UPPER UMBILICALS & AFT PLATE LANYARD PULL 4) S/C SEP. SWITCH CONTINUITY IND. LOCKUP (GSE) 5) UMBILICAL EJECT SIGNAL TO GUIDANCE GSE a) GUIDANCE READY LOCKUP b) FLIGHT MODE ACCEPT LOCKUP b. EJECT SEQUENCE COMPLETE INDICATIONS 1) UPPER UMBILICALS ELECTRICALLY EJECTED a) AUTOPILOT & PROPULSION UMBILICAL (B600U401 REF) EJECTED (LOOP OPEN) b) AUXILIARY PROPULSION UMBILICAL (B600U402 REF) EJECTED (LOOP OPEN) c) POWER & TELEMETRY UMBILICAL (B600U403 REF) EJECTED (LOOP OPEN) d) GUIDANCE UMBILICAL (B600U404 REF) EJECTED (LOOP OPEN)	(2024A4K1) 2106A6K2 5096A6K3 5037A6K1 2105A7K2 2106A1K2	LANYARD PULL B/U
T-3.21	CN 1351 X (0) CN 1352 X (0) CN 1353 X (0) CN 1354 X (0) CN 1396 X (0)	T-3.14 T-3.07 B/U T-3.06	c. AFT PLATE EJECTED BY PNEUMATIC UNLATCH (MATE SENSOR LOOP OPEN - B600W/P412 REF) c. UPPER UMBILICALS & AFT PLATE EJECTED (NOMINAL TIME ASSUMES AFT PLATE LANYARD PULL) NOTE: AFT PLATE INCLUDES THE FOLLOWING: a) LL INSTRUMENTATION UMBILICALS b) LH ₂ & LO ₂ TANK ULLAGE PRESSURE DISCONNECTS c) HELIUM CHARGE & PURGE PRESSURE DISCONNECTS d) TURBO PUMP HELIUM CHILLDOWN DISCONNECT e) INTERMEDIATE BULKHEAD VACUUM DISCONNECT f) AFT PLATE MATE SENSOR UMBILICAL	2106A6K4 B105P9 & B105P11 B600P412
	CN 1356 X (0) CN 1357 X (0)			

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EVENT SEQUENCE AND TIMES (CONT'D)

		UPPER UMBILICALS & AFT PLATE EJECTION IS INDICATED BY 2106A6K4 RELAY DROPOUT.
7.	ATLAS ENGINES IGNITION START THRU SUSTAINER FLIGHT LOCK-IN	<p>NOTES: 1) ENGINES IGNITION START INITIATION CONTINGENT UPON:</p> <ul style="list-style-type: none"> a) ENGINE CONTROL ARM SWITCH ARMED (2024S13C) b) "ENGINE START" RELAY LOCKUP (5092K31C) c) ATLAS START TANKS PRESSURIZED (5092K34C & K36C) d) MANUAL OR AUTOMATIC ENGINE CUTOFF (5092K911C REF) e) "VEHICLE DISCONNECT" RELAY NOT ACTIVATED (5092K81C REF) f) CENTAUR FUEL (LH₂) VENT VALVE LOCK (5035A7K9) g) UPPER UMBILICALS & AFT PLATE EJECTED (2106A6K4) (RELAY DROPOUT) h) TCC GUIDANCE FLIGHT MODE ACCEPT (2098A9K5) i) FOUR SECOND DELAY TIMER PICKUP (2098A4K1) <p>2) ACTUAL ELAPSED TIME FROM ATLAS TANKS PRESSURIZED TO ENGINES IGNITION START IS NOT TO EXCEED 30 SECONDS.</p> <p>3. ATLAS ENGINES IGNITION START</p> <p>NOTE: ENGINE CUTOFF AFTER IGNITION START IS TO BE CONSIDERED CAUSE FOR LAUNCH ABORT.</p> <ol style="list-style-type: none"> 1) VERNIER ENGINES IGNITION START 2) IGNITION STAGE LIMITTER START (2.4 SEC TIMER) 3) ATLAS GYROS UNNULL COMMAND 4) ATLAS THRUST CHAMBER PURGE ENABLE 5) ATLAS GAS GENERATORS IGNITION START 6) ATLAS STAGE VALVES TO "OPEN" COMMAND a) IGNITION STAGE VALVES TO "OPEN" COMMAND b) VERNIER ENGINES FLIGHT LOCK-IN COMMAND c) "VERNIER FLIGHT LOCK-IN COMMAND" SIGNAL TO TEST CONDUCTOR SYSTEM <p>b. ATLAS VERNIER ENGINES FLIGHT LOCK-IN NOTE: AN ATLAS ENGINES CUTOFF SIGNAL WILL BE INITIATED IF GROUND POWER FAILS AFTER ATLAS ENGINES FLIGHT LOCK-IN OCCURS AND THE VERNIER VALVES CONTROL RELAY IS ACTI- VATED. THIS CUTOFF IS DISABLED AT PRE- RELEASE CUTOFF DISARM.</p> <ol style="list-style-type: none"> 1) TCC VERNIER FLIGHT LOCK-IN INDICATION
		AP 1441 X (1)
		AP 1611 X (1)
		AP 1612 X (1)
		AP 1621 X (1)
		AP 1101 X (1)
T-3.05		
T-3.04		

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EVENT SEQUENCE AND TIMES (CONT'D)

ACTUAL EVENT TIME	NOMINAL	LL MEASUREMENT ACTIVATED (1) DEACTIVATED (0)	FUNCTION DESCRIPTION	REMARKS	REV LTR
T-0.14			H. LAUNCH COUNTDOWN AUTOMATIC SEQUENCE EVENTS (CONT'D) <ul style="list-style-type: none"> a) LADDER FAULT CUTOFF LIMITER START (5.25 SECOND TIMER) b) RELEASE FAILURE CUTOFF LIMITER START (8.50 SECOND TIMER) 2) VERNIER #1 PROPELLANT VALVE TO "OPEN" <ul style="list-style-type: none"> a) VALVE CLOSED INDICATION DROPOUT b) VALVE OPEN INDICATION (MONITOR LIGHT) 3) VERNIER #2 PROPELLANT VALVE TO "OPEN" <ul style="list-style-type: none"> a) VALVE CLOSED INDICATION DROPOUT b) VALVE OPEN INDICATION (MONITOR LIGHT) c. ATLAS VERNIER ENGINES COMPLETE (MONITOR LIGHTS) CONTINGENT UPON: <ul style="list-style-type: none"> 1) VERNIER #1 CHAMBER PRESSURE SWITCH "ON" 2) VERNIER #2 CHAMBER PRESSURE SWITCH "ON" 3) VERNIER FLIGHT LOCK-IN NOTE: IF ATLAS VERNIER ENGINES IGNITION IS NOT INDICATED (VISUAL OBSERVATION), PRIOR TO BLOCK-HOUSE MONITOR SEQUENCER T-0 TIME, A MANUAL COMPLETE CUTOFF COMMAND IS INITIATED AND LAUNCH ABORT OPERATIONS ARE STARTED.	2108A1K1 2108A1K2 5092K45C 2024DS45C2 REF 5092K46C 2024DS46C2 REF 2010DS48C REF TCC 2104DS37 REF 5092K47C 5092K48C (5092K441C)	
T-2.55		AP 1073 X (0) AP 1172 X (1)			
T-2.90		AP 1074 X (0) AP 1174 X (1)			
T-3.00		AP 1613 X (1)			
T-2.90		AP 1614 X (1)			
T-2.55	(T-3.05)	AP 1101 X (1)			
	REF				
T-2.95		AP 1199 X (0) AP 1198 X (1)			
T-2.35			1) SUSTAINER LO ₂ HEAD SUPPRESSION VALVE TO "OPEN" <ul style="list-style-type: none"> a) VALVE CLOSED INDICATION DROPOUT b) VALVE OPEN INDICATION (MONITOR LIGHT) 2) BOOSTER #1 MAIN LO ₂ VALVE TO "OPEN" <ul style="list-style-type: none"> a) VALVE CLOSED INDICATION DROPOUT b) VALVE OPEN INDICATION (MONITOR LIGHT) 3) BOOSTER #2 MAIN LO ₂ VALVE TO "OPEN" <ul style="list-style-type: none"> a) VALVE CLOSED INDICATION DROPOUT b) VALVE OPEN INDICATION (MONITOR LIGHT) e. ATLAS MAIN STAGE IGNITION COMPLETE - MAIN STAGE LIMITER START (1.7 SECOND TIMER)	5092K64C 2024DS64C1 REF 5092K62C 2024DS62C1 REF 5092K63C 2024DS63C1 REF 5092K72C 5092K71C NOTE: UNLESS MAIN STAGE IGNITION COMPLETE OCCURS PRIOR TO IGNITION STAGE LIMITER PICKUP (RUN-OUT) AN ENGINE AUTO-CUTOFF WILL BE INITIATED AT REFERENCED CLOCK TIME. (5092K41C)	
T-2.90		AP 1067 X (0) AP 1169 X (1)			
T-2.69					
T-2.17					
(T-0.66)	REF	AP 1441 X (0)			

EVENT SEQUENCE AND TIMES (CONT'D)

	T-2.17	AP 1616 X (1) AP 1622 X (1)	1) BOOSTER & SUSTAINER FLIGHT LOCK-IN COMMAND INITIATION 2) SUSTAINER FLIGHT LOCK-IN INDICATED - VEHICLE DISCONNECT RELAY ACTIVATED (GSE) NOTE: THE FOLLOWING ENGINE GROUND CONTROL RELAY DROPOUTS OCCUR AT THIS TIME: a) THRUST CHAMBER IGNITION b) GAS GENERATOR IGNITION LINKS c) ENGINE PREPARATION COMPLETE d) VEHICLE PREPARATION COMPLETE (START READY AP 1575 X (1) RETAINED)	(K73C & K74C A/B) 5092K81C
	T-2.16	AP 1611 X (0) AP 1612 X (0) AP 1137 X (0)	8. ATLAS SUSTAINER FLIGHT LOCK-IN THRU MAIN ENGINES COMPLETE a. MAIN STAGE CONTROL VALVES TO "OPEN" 1) BOOSTER #1 FUEL VALVE TO "OPEN" a) VALVE CLOSED INDICATION DROPOUT b) VALVE OPEN INDICATION (MONITOR LIGHT) 2) BOOSTER #2 FUEL VALVE TO "OPEN" a) VALVE CLOSED INDICATION DROPOUT b) VALVE OPEN INDICATION (MONITOR LIGHT) 3) SUSTAINER FUEL P/U VALVE TO "OPEN" a) VALVE CLOSED INDICATION DROPOUT b) VALVE OPEN INDICATION (MONITOR LIGHT) 4) BOOSTER GAS GENERATOR VALVE TO "OPEN" a) VALVE CLOSED INDICATION DROPOUT b) VALVE OPEN INDICATION (MONITOR LIGHT) 5) SUSTAINER GAS GENERATOR VALVE TO "OPEN" a) VALVE CLOSED INDICATION DROPOUT b) VALVE OPEN INDICATION (MONITOR LIGHT)	5092K77C 2024DS77C2 REF 5092K78C 2024DS78C2 REF 5092K79C 2024DS79C2 REF 5092K75C 2024DS75C2 REF 5092K76C 2024DS76C2 REF 2096A8K5 2096A8K13 2106A6K3
	T-2.06	AP 1070 X (0) AP 1194 X (1)	b. ATLAS INTERNAL HYDRAULIC PRESSURES READY 1) BOOSTER INTERNAL HYDRAULIC PRESSURE READY NOTE: HYDRAULIC PUMP ON BOOSTER #2 ONLY. 2) SUSTAINER INTERNAL HYDRAULIC PRESSURE READY 3) TCC ATLAS INTERNAL HYDRAULIC PRESSURES READY - PRE-REQUISITE TO DISARM THE PRE-RELEASE CUTOFF	2096A8K5 2096A8K13 2106A6K3
	T-2.01	AP 1069 X (0) AP 1195 X (1)	c. ATLAS MAIN ENGINES CONTROL COMPLETE 1) SUSTAINER FUEL MANIFOLD PRESSURIZED (PRESSURE SWITCH "ON" INDICATED) 2) BOOSTER #1 FUEL INJ. MANIFOLD PRESSURIZED (PRESSURE SWITCH "ON" INDICATED)	5092K82C 5092K83C
	T-2.06	AP 1203 X (0) AP 1202 X (1)		
	T-1.56	AP 1147 X (1)		
	T-2.06	AP 1071 X (0) AP 1147 X (1)		
	T-1.65	AP 1335 X (0) AP 1499 X (1)		
	T-2.06	AH 1146 X (1)		
	T-1.19	AH 1147 X (1)		
	T-1.17	AH 1392 X (1)		
	T-0.95	AP 1623 X (1)		
	T-0.93	AP 1618 X (1)		

EVENT SEQUENCE AND TIMES (CONT'D)

EVENT TIME ACTUAL	EVENT TIME NOMINAL	LL MEASUREMENT ACTIVATED (1) DEACTIVATED (0)	FUNCTION DESCRIPTION	REMARKS	REV LTR
T-0.89	AP 1619 X (1)	H. LAUNCH COUNTDOWN AUTOMATIC SEQUENCE EVENTS (CONT'D)			
T-0.88	AP 1626 X (1)	3) BOOSTER #2 FUEL INJ. MANIFOLD PRESSURIZED (PRESSURE SWITCH "ON" INDICATED)	5092K80C		
		4) ATLAS MAIN ENGINES COMPLETE (ENGINE CONTROL RELAY LOCKUP)	5092K84C		
T-0.89	AP 1198 X (0)	d. SUSTAINER VALVES CONTROL STAGE	2024DS64C 2 REF		
T-0.85	AP 1202 X (0)	1) SUSTAINER LO ₂ HEAD SUPPRESSION VALVE TO "CONTROL" (MONITOR LIGHT OFF)	2024DS79C 2 REF		
(T-0.47) REF	AP 1617 X (0)	2) SUSTAINER FUEL P/U VALVE TO "CONTROL" (MONITOR LIGHT OFF)			
		NOTE: UNLESS MAIN ENGINES COMPLETE OCCURS PRIOR TO MAIN STAGE LIMITER PICKUP (RUNOUT) AN ENGINE AUTO-CUTOFF WILL BE INITIATED AT REFERENCED CLOCK TIME.	(5092K71C)		
		ENGINE CUTOFF IS CONSIDERED CAUSE FOR LAUNCH ABORT.			
		9. ATLAS MAIN ENGINES COMPLETE THRU RELEASE SIGNAL			
T-0.87	AP 1624 X (1)	INITIATION			
		a. TCC ATLAS MAIN ENGINES COMPLETE INDICATION	2106A6K1		
		1) RELEASE LADDER COMPLETE	2106A7K1		
		CONTINGENT UPON:			
		a) TCC ATLAS MAIN ENGINES COMPLETE	2106A6K1		
		b) TCC ATLAS INTERNAL HYDRAULIC PRESSURES READY	2106A6K3		
		c) TCC CENTAUR UPPER UMBILICALS & AFT PLATE EJECTED INDICATION (RELAY DROPOUT)	2106A6K4		
		d) TCC CENTAUR UPPER UMBILICALS & AFT PLATE EJECT COMMAND (RETAINED)	2106A6K2		
		e) NAA BOOSTER C/O (TCC) RELAY NOT ACTIVATED (PRIMARY CUTOFF NOT INITIATED)	2106A1K3		
		f) TCC PRE-START LADDER COMPLETE (RETAINED) CONTINGENT UPON:	2106A1K1		
		(1) BOOM SYSTEM READY	2105A6K4		
		(2) 2ND STAGE PRESSURE READY	2105A1K2		
		(3) 1ST STAGE RANGE SAFETY READY	2105A2K3		
		(4) 2ND STAGE RANGE SAFETY READY	2105A7K1		
		(5) 1ST STAGE TELEMETRY READY	2105A2K2		

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EVENT SEQUENCE AND TIMES (CONT'D)

	<ul style="list-style-type: none"> (6) 2ND STAGE TELEMETRY READY (7) 2ND STAGE POWER INTERNAL (8) 1ST STAGE TANKING READY (9) 1ST STAGE POWER INTERNAL (10) 2ND STAGE ENGINES READY (11) 2ND STAGE TANKING READY (12) 1ST STAGE INTERNAL PNEUMATICS READY (13) PAYLOAD DISCONNECT READY NOTE: SPACECRAFT SEPARATION SWITCH CONTINUITY IS NOT SENSED AT THIS TIME. (14) 2ND STAGE FLIGHT CONTROL READY (15) 1ST STAGE FLIGHT CONTROL READY (16) ENGINE START <p>NOTE: THE FOLLOWING EVENTS ARE CONTINGENT UPON RELEASE LADDER BEING COMPLETE (9.a.1 REF) AND NO ENG. C/O (2108A6K3)</p> <p>b. ATLAS ENGINE CONTROL PRE-RELEASE CUTOFF DIS- ABLED, 1ST & 2ND STAGE PRESSURE CONTROL LOCK- OUT & RELEASE HOLDDOWN TIMER START-TCC</p> <ol style="list-style-type: none"> 1) ATLAS ENGINE CONTROL PRE-RELEASE CUTOFF DISARM - ENGINE CONTROL RESET a) PRE-RELEASE CUTOFF DISARM b) ENGINE CONTROL RESET - C/O DISABLE IS CON- TINGENT UPON: <ol style="list-style-type: none"> (1) +28 VDC VEHICLE POWER THRU ATLAS UMBILICAL (MATED). (2) BOOSTER PRIMARY CUTOFF RELAY NOT ACTIVATED (3) PRE-RELEASE CUTOFF DISARM RELAY ACTIVATED c) MAIN ENGINES COMPLETE TO SEQUENCER <p>AP 1596 X (1) AP 1639 X (1)</p> <p>T-0.87</p>	<ul style="list-style-type: none"> 2105A1K4 2105A1K3 2105A7K3 2105A2K1 2105A1K1 2105A7K4 2105A2K4 2106A7K4 <p>(REF H.6. a. 4)</p> <ul style="list-style-type: none"> 2105A3K1 2105A3K3 2106A7K2 <p>5092K85C</p> <p>5092K86C</p> <p>J/P1005 REF</p> <p>5092K91C</p> <p>5092K85C</p> <p>TO (RCA) TB6-13 THRU 2106A6K1</p> <p>5041A7K1 & A7K4</p> <p>5040A3K5</p> <p>5040A3K6 & A3K7</p>
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EVENT SEQUENCE AND TIMES (CONT'D)

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EVENT TIME ACTUAL	LL MEASUREMENT ACTIVATED (1) DEACTIVATED (0) NOMINAL	FUNCTION DESCRIPTION	REMARKS	REV LTR
		H. LAUNCH COUNTDOWN AUTOMATIC SEQUENCE EVENTS (CONT'D) (3) VEHICLE HELIUM C/O VALVE LOCKUP (CLOSE COMMAND DISABLE) (4) VEHICLE LO ₂ BOIL-OFF VALVE LOCKUP (OPEN COMMAND DISABLE) (5) PRESSURIZATION STEP III RESET DISABLE 2106A2K1 2083A8K11 3) HOLDDOWN TIMER (0.07 SECONDS DELAY) START 4) PROPELLANT TANK ISOLATION-2ND STAGE NOTE: MANUAL OR AUTOMATIC (GSE) ATLAS ENGINE CUTOFF CANNOT BE INITIATED AFTER ENGINE PRE-RELEASE DISARM OCCURS UNLESS: 1) ONE OR MORE VEHICLE RELEASE PREREQUISITES ARE NOT RETAINED PRIOR TO HOLDDOWN TIMER (0.07 SEC) PICKUP AND NOT RECOVERED AT TIME OF LADDER FAULT CUTOFF LIMITER PICKUP AT REFERENCED CLOCK TIME. 2) VEHICLE 2" MOTION (T-0 REFERENCE) DOES NOT OCCUR PRIOR TO RELEASE FAILURE CUTOFF LIMITER PICKUP AT REFERENCED CLOCK TIME. AN ENGINE CUTOFF WILL OCCUR ONE SECOND AFTER LADDER FAULT CUTOFF TIMER PICKUP UNLESS ALL RELEASE LADDER COMPLETE PREREQUISITES ARE MET, PRE-RELEASE CUT- OFF DISARM OCCURS AND THE RELEASE SIGNAL IS INITIATED. THE REFERENCED CUTOFF TIMES ARE BASED ON TIMER RUN- OUT RATHER THAN ACTUAL COUNTDOWN TIME AS INDICATED BY THE SEQUENCER CLOCK. 10. RELEASE SIGNAL-INITIATION TO VEHICLE 2" MOTION a. HOLDDOWN TIMER PICKUP 1) HOLDDOWN TIMER DELAY RUNOUT IS CONTINGENT UPON ALL RELEASE LADDER PREREQUISITES BEING RETAINED AT THIS TIME (9.a.1 & 9.b. REF). 2) RELEASE SIGNAL INITIATED AND LOCKED a) +28 VDC EXCITATION IS SUPPLIED FOR 2" MOTION EVENTS BACKUP ENABLE. b) SLAVE CYLINDERS PRESSURE CONTROL VALVE TO "RELEASE" POSITION (7533 REF)	LAUNCH COMMIT 2106A2K1 CHARGE HOLDDOWN (2092CB1) DROPOUT	
T-0.80		AP 1577 X (1)		
T-0.60				

EVENT SEQUENCE AND TIMES (CONT'D)

				(7531 & 7532 REF)
T-0.54	AN 1820 X (0)	c) SLAVE CYLINDERS (QUAD I & II) TO "HOLDDOWN MASTER CYLINDERS VENT" CONTROL POSITION (BLOWDOWN START) d) TCC HOLDDOWN & RELEASE READY INDICATION DROPOUT	b. VEHICLE RELEASE POINT 1) RELEASE PRESSURE (B1 SIDE CYLINDER) 2) RELEASE PRESSURE (B2 SIDE CYLINDER) c. VEHICLE 2" MOTION (T-0 REFERENCE TIME) NOTES: 1) VEHICLE 2" MOTION IS NORMALLY INDICATED BY 2" MOTION SWITCH AND INITIATION OF SUBSEQUENT EVENTS. 2) A BACKUP 2" MOTION SIGNAL IS INITIATED BY ATLAS UMBILICALS P1002 AND P1005 EJECTION. 3) SEQUENCER IS AUTOMATICALLY RESET TO T+0 AT VEHICLE 2" MOTION.	2105A6K2
T-0, T+0	AL 1127 P (P) AL 1128 P (P) AM 1030 X (1)	CN 1474 X (1)	11. VEHICLE 2" MOTION INITIATED EVENT SEQUENCE NOTES: 1) AN AUTO CUTOFF WILL OCCUR ONE SECOND AFTER RELEASE FAILURE CUTOFF LIMITER PICKUP UNLESS VEHICLE 2" MOTION OCCURS PRIOR TO REFERENCE (NOT RESET) CLOCK TIME. 2) RESET OF PRE-RELEASE CUTOFF DISARM BY RELEASE FAILURE CUTOFF LIMITER ENABLES AUTO OR MANUAL ENG. CUTOFF UNDER ABOVE MENTIONED CONDITIONS.	5103K11 & K12 OR 2" MOTION B/U
T-0, T+0 (T + 6.45) REF			3) GROUND CONTROL INITIATED CUTOFF OF ATLAS ENGINES IS CONTINGENT UPON ATLAS UMBILICAL J/P1005 BEING MATED. THE FOLLOWING EVENT SEQUENCE IS INITIATED BY VEHICLE 2" MOTION. SIGNAL IS RETAINED TO 42" MOTION. a. 1ST STAGE FLIGHT CONTROL SYSTEM 1) ATLAS PROGRAMMER START a) INDICATED BY ATLAS PROGRAMMER ZERO SIGNAL 2) DISABLE PROGRAMMER STOP b. 1ST STAGE PURGE CONTROL SYSTEM 1) 2" RISEOF SIGNAL - PURGE CONTROL SYSTEM (ISOLATION OF COMMAND SIGNAL REQUIRED) NOTE: 2" RISEOFF RELAY LOCKUP THRU N.O. CONTACTS AND N.C. RESET SWITCH 2) PANEL POWER "OFF" (RELAY DROPOUT) +28 VDC (+DT712) BUS DE-ENERGIZED b) AC PANEL POWER "OFF" (RELAY DROPOUT)	5045A7K2 (209756) 5044A3K1 5045A3K2
		AS 1600 X (0)		5045A7K2 (209756) 5044A3K1 5045A3K2

EVENT SEQUENCE AND TIMES (CONT'D)

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EVENT TIME ACTUAL	LL MEASUREMENT ACTIVATED (1) DEACTIVATED (0)	FUNCTION DESCRIPTION	REMARKS	REV LTR	
2-08-20		<p>H. LAUNCH COUNTDOWN AUTOMATIC SEQUENCE EVENTS (CONT'D)</p> <p>c. 1ST STAGE HYDRAULICS CONTROL SYSTEM 1) 2" RISEOFF SIGNAL - HYDRAULIC CONTROL SYSTEM a) BOOSTER HYDRAULIC PUMP STOP (1) "RUN" RELAYS DROPOUT b) SUSTAINER HYDRAULIC PUMP STOP (1) "RUN" RELAYS DROPOUT NOTE: BOOSTER & SUSTAINER PUMP STOP CONDITION IS RETAINED AFTER STOP SIGNAL REMOVAL.</p> <p>d. 2" MOTION SIGNAL TO TEST CONDUCTOR SYSTEM 1) 2" MOTION (TCS) 2) "FIRST MOTION" SIGNAL TO SEQUENCER</p> <p>e. 1ST AND 2ND STAGE PROPELLANT TANKING CONTROL SYSTEM 1) VEHICLE 2" RISEOFF RELAY ACTIVATION (10 SEC T.D.D.O.) 2) VEHICLE 2" RISEOFF SLAVE RELAY ACTIVATION a) 2ND STAGE LO₂ FLOW CONTROL VALVE CLOSE COMMAND b) 2ND STAGE LO₂ VENT VALVE CLOSE COMMAND c) 2ND STAGE LO₂ FILL AND DRAIN VALVE OPEN DISABLE d) 1ST STAGE LO₂ FILL AND DRAIN VALVE POWER DROPOUT e) 1ST STAGE RP-1 FILL AND DRAIN VALVE POWER DROPOUT</p> <p>f. UMBILICAL GROUND CONTROL SYSTEM NOTE: PRIME EJECTION OF THE ELECTRICAL UMBILI- CALS IS BY SOLENOID ACTIVATION: BACKUP IS BY LANYARD PULL. 1) ATLAS PROPELLANT LOADING UMBILICAL - EJECTED 2) ATLAS VEHICLE POWER UMBILICAL - EJECTED 3) ATLAS SUSTAINER TANKING & PNEUMATICS - EJECTED 4) ATLAS BOOSTER TANKING & PNEUMATIC UMBILICAL - EJECTED 5) CENTAUR T-0 UMBILICAL - EJECTED 6) ATLAS LL INSTRUMENTATION UMBILICAL - EJECTED</p>	AN 1061 X (0) AN 1062 X (0) AN 1063 X (0) AN 1064 X (0) CN 1358 X (0) AN 1065 X (0)	2096A8K11 4501(B)K29 4501(B)K1a & b 4501(S)K29 4501(S)K1a & b 2108A7K1 TO (RCA) TB6-10 THRU 2108A7K1 5030A2K1 5030A4K2 5030A3K4 5030A3K1 5030A3K2 5095A6K4 5095A6K2 600P1002 600P1003 600P1005 600P1007 B600P409 600P4001	

EVENT SEQUENCE AND TIMES (CONT'D)

		<p>NOTE: ATLAS UMBILICALS LANYARD PULL EJECT (BACKUP) IS BY VEHICLE MOTION. CENTAUR (T-0) UMBILICAL LANYARD PULL EJECT (BACKUP) IS BY BOOM CONTROL SYSTEM.</p> <p>g. ATLAS SUPPLY LINES DISCONNECT</p> <ol style="list-style-type: none"> 1) AIRCONDITION LINES DISCONNECT 2) RISEOFF PLATES (HYDRAULIC & PNEUMATIC LINES) DISCONNECT <p>NOTE: WHEN ATLAS UMBILICALS P1002 AND P1005 ARE EJECTED EITHER ELECTRICALLY OR BY LANYARD, A BACKUP SIGNAL IS PROVIDED FOR THE 2" MOTION EVENTS 11.a THRU 11.f.</p> <p>h. 2" RISEOFF SIGNAL - BOOM CONTROL SYSTEM</p> <p>NOTE: 2" MOTION BACKUP BY ATLAS UMBILICALS P1002 AND P1005 EJECTED OR VEHICLE 8" MOTION SIGNAL.</p>
(T+0.07)	CN 1474 X (1) REF	<ol style="list-style-type: none"> 1) CENTAUR T-0 UMBILICAL EJECT BACKUP BY LANYARD PULL 2) CENTAUR LH₂ FILL & DRAIN LINE DISCONNECT 3) CENTAUR LO₂ FILL & DRAIN LINE DISCONNECT 4) CENTAUR AIRCONDITION LINES DISCONNECT <ul style="list-style-type: none"> a) THRUST SECTION HEATING b) EQUIPMENT SECTION COOLING c) PAYLOAD COOLING 5) GH₂ VENT 6) GAS LEAK DETECTION (SURVEYOR) 7) A/B PURGE BOTTLE CHARGE LINE DISCONNECT 8) LOWER BOOM RETRACT DELAY TIMER START (0.25 SECOND TIMER) 9) UPPER BOOM RETRACTION START <ul style="list-style-type: none"> a) POSITION IN DEGREES INDICATED b) OPERATING PRESSURE IN PSIA INDICATED <p>12. VEHICLE 8" MOTION INITIATED EVENT SEQUENCE</p> <p>NOTES: 1) VEHICLE 8" MOTION IS SENSED BY 8" MOTION SWITCH AND NORMALLY INITIATES 8" MOTION EVENT COMMANDS.</p> <p>2) BACKUP FOR ATLAS AUTOPILOT UMBILICAL P1001 ELECTRICAL EJECTION BY SOLENOID ACTIVATION IS PROVIDED BY VEHICLE MOTION LANYARD PULL.</p> <p>3) LOWER BOOM HYDRAULIC VALVES (V5 AND V6) CONTROL IS PROVIDED BY EITHER VEHICLE 8" MOTION OR BY LOWER BOOM RETRACT DELAY RELAY RUNOUT.</p>
T+0.01	CN 1569 D (°) CN 1454 P (P)	AN 1827 X (1)
T+0.20		5103K15 S1002
T+0.26		

EVENT SEQUENCE AND TIMES (CONT'D)

EVENT TIME ACTUAL	EVENT TIME NOMINAL	LL MEASUREMENT ACTIVATED (1) DEACTIVATED (0)	FUNCTION DESCRIPTION	REMARKS	REV LTR
T+0.29	AN 1060 X (0)	H. LAUNCH COUNTDOWN AUTOMATIC SEQUENCE EVENTS (CONT'D) NOTES: 4) VEHICLE 8" RISEOFF RELAY ACTIVATION IS RETAINED UP TO VEHICLE 42" MOTION. 5) LOWER BOOM RETRACT DELAY SIGNAL IS RETAINED UP TO VEHICLE 42" MOTION.			
T+0.45	CN 1568 D () CN 1452 P (P)	a. ATLAS AUTOPILOT UMBILICAL EJECTED b. UNGROUND ATLAS FILTER SERVO NULLING AMPLIFIERS c. LOWER BOOM CONTROL PILOT VALVES TO "OPEN" 1) DELAY TIMER PICKUP OR 2) 8" RISEOFF INDICATED d. LOWER BOOM RETRACTION START 1) POSITION IS INDICATED IN DEGREES 2) OPERATING PRESSURE IS INDICATED IN PSIA	600P1001 600P1001 V5 & V6 REF 5037A3K1		
T+0.98	AN 1066 X (0)	e. 2" MOTION BOOM CONTROL BACKUP SIGNAL IS INITIATED 13. VEHICLE 42" MOTION - EXTENDED RISEOFF UMBILICAL DISCONNECT a. "EJECT READY" RELAY DROPOUT 1) 2" RISEOFF RELAYS DROPOUT 2) 8" RISEOFF RELAY DROPOUT b. 42" RISE INDICATED (MONITOR LIGHT) c. "EJECT READY" INDICATION RETAINED 1) EJECT READY INDICATED (MONITOR LIGHT) 2) EJECT READY SLAVE RELAY ACTIVATED d. 42" RISEOFF RELAY DROPOUT 14. LOWER BOOM RETRACTED TO 55° FROM INITIAL POSITION 15. UPPER BOOM RETRACTED TO 50° FROM INITIAL POSITION 16. COMPLETE CUTOFF - RELEASE C/O LIMITER NOTE: UNDER NORMAL VEHICLE LAUNCH CONDITIONS GROUND CONTROL SYSTEM CUTOFF WILL NOT OCCUR AT THIS TIME UNLESS VEHICLE 2" MOTION OCCURS PRIOR TO REFERENCED TIME, ENGINE C/O OCCURS.	5037A7K1 600P609 5037A2K1 5103K11 & K12. 5103K15 2104DS49 5037DS1 5037A8K13 5030A4K1 2098A9K3		
T+3.70 T+4.10	CN 1568 D () CN 1569 D ()				
T-3.04	AP 1102 X (1) PLUS 9.0 SEC (T + 6.45) REF				

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TABLE 2. MEANS AND LIMITATIONS FOR LAUNCH COUNTDOWN AUTOMATIC SEQUENCE
INTERRUPTION AND/OR ENGINES CUTOFF

COMMAND	EFFECTIVE FROM	EFFECTIVE TO	MODE
1. AUTOMATIC SEQUENCE RESET	AUTOMATIC SEQUENCE START	GUIDANCE FLIGHT MODE ACCEPT	MANUAL
2. TC BOOSTER CUTOFF	AUTOMATIC SEQUENCE START	RELEASE LADDER COMPLETE +0.01 SEC	MANUAL
3. TC SUSTAINER CUTOFF	AUTOMATIC SEQUENCE START	RELEASE LADDER COMPLETE +0.01 SEC	MANUAL
4. TC COMPLETE CUTOFF	AUTOMATIC SEQUENCE START	RELEASE LADDER COMPLETE +0.01 SEC	MANUAL
5. ATLAS PRESSURE FAILURE CUTOFF	GUIDANCE FLIGHT MODE ACCEPT	ATLAS MAIN STAGE IGNITION COMPLETE	AUTO
6. IGNITION STAGE LIMITER CUTOFF	VERNIER IGNITION START +2.4 SEC	ATLAS MAIN STAGE IGNITION COMPLETE	AUTO
7. GROUND POWER FAILURE CUTOFF	VERNIER FLIGHT LOCK-IN	ATLAS MAIN STAGE IGNITION COMPLETE	AUTO
8. LADDER FAULT CUTOFF	VERNIER FLIGHT LOCK-IN +6.25 SEC	RELEASE LADDER COMPLETE +0.07 SEC	AUTO
9. RELEASE FAILURE CUTOFF	VERNIER FLIGHT LOCK-IN +9.00 SEC	VEHICLE 2" MOTION (T-0 REF)	AUTO
10. MAIN STAGE LIMITER CUTOFF	MAIN STAGE IGNITION COMPLETE +1.7 SEC	ATLAS MAIN ENGINES COMPLETE	AUTO
11. BOOSTER CUTOFF AIRBORNE	AUTOMATIC SEQUENCE START	ATLAS UMBILICAL P1005 EJECTED *	*
12. SUSTAINER CUTOFF AIRBORNE	AUTOMATIC SEQUENCE START	ATLAS UMBILICAL P1005 EJECTED *	*
13. COMPLETE CUTOFF AIRBORNE	AUTOMATIC SEQUENCE START	ATLAS UMBILICAL P1005 EJECTED *	*
14. COMPLETE CUTOFF - RANGE SAFETY COMMAND	RANGE SAFETY COMMAND (MECO) REF.	IN EMERGENCIES A RSC MECO CAN BE INITIATED AT ANY TIME PRIOR TO AND AFTER VEHICLE RISEOFF	RF LINK

*NOTE: CUTOFF IS INITIATED BY EITHER GROUND
COMMAND, RSC COMMAND, OR VEHICLE
SYSTEM MALFUNCTION. GROUND COM-
MAND IS DISABLED BY PRE-RELEASE CUT-
OFF DISARM.

GDC-BNZ64-042-08
31 DECEMBER 1965

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